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ABSTRACT

A plan for evaluating the Apple Classroom of Tomorrow (ACOT) is presented, which implements the model for Sensible Technology Assessment/Research (STAR). STAR involves interactive participation in the evaluation study by ACOT participants, collateral university researchers, and University of California (Los Angeles) staff to develop a credible, adaptive set of assessment plans, procedures, and reports assessing the ACOT experiment; a phased implementation of STAR designed to conform to the rhythms of site-by-site implementation; and a focus on exploring the utility of developing STAR into a multi-user evaluation system for future coordinated implementation with new technology adoption in local districts. The STAR evaluation will be guided by questions concerning: (1) the effects of ACOT on students; (2) the influence of ACOT on organization and delivery of instruction; (3) the effects of ACOT on teachers; (4) the effects of ACOT on students' families; and (5) unintended effects that may be attributed to ACOT. The comparative impact of ACOT will be investigated for three groups of students: ACOT students over time; students at one grade level taught by an increasingly experienced ACOT teacher; and ACOT and non-ACOT students in the same and different schools. Investigation of the effects of ACOT on students will consider academic achievement, criterion-referenced student writing, problem solving, locus of control or sense of efficacy, attitudes toward school or motivation for schooling, academic self-concept, future educational and career plans, use of time at home, and site-specific and instructional goals. Similar issues will be considered for teachers and families. The evaluation was scheduled to begin in Spring 1988 at three selected ACOT sites in Memphis (Tennessee), Nashville (Tennessee), and Columbus (Ohio). (SLD)

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Introduction

This document presents a plan for evaluating the Apple Classroom of Tomorrow (ACOT). Our plan implements the model for Sensible Technology Assessment/Research (STAR) and has multiple antecedents. First, it derives from our historical perspective of critical issues and approaches to the assessment of innovation. More specifically, it embodies principles identified in the paper submitted to Apple Computer in December, entitled "Sensible, Sensitive Technology Assessment." More immediately, it has a derived, as well as interactive relationship with the first-cut model of STAR, briefly pictured and described on a companion document, "A Model for Sensible Technology Assessment/Research (STAR)." It is our hope to adapt the STAR model and implementation mutually and dynamically as we progress through various phases of the ACOT evaluation.

Among the major points of STAR are the following:

- Interactive participation in the evaluation study by ACOT participants, collateral university researchers, and UCLA staff to develop a credible, adaptive set of assessment plans, procedures, and reports assessing the ACOT experiments.
- A phased implementation of STAR designed to conform to the rhythms of site by site implementation
- A focus on exploring the utility of developing STAR into a multiuser evaluation system, for future, coordinate implementation with new technology adoption in local districts

The STAR approach is at once simple and complex, depending upon one's view. It relies upon our implementing a model of evaluation, cycling through differential emphases, as appropriate to decision requirements, the model and available resources, and determining which questions-procedure-analysis configurations are useful, credible, and technically sensitive enough to deserve a major slot in the optimal STAR system. The evaluation will be guided by a relatively straightforward set of questions:

- What are the effects of ACOT on students?
- How does ACOT influence the organization and delivery of instruction?
- How does ACOT affect teachers?
- What are ACOT effects on the family of ACOT students?
- What other unintended effects, either positive or negative, may be attributed to ACOT?

Technical Approach

The ways we find answers to these issues relates to two major decision arenas: the design for the study and the measures used to obtain evidence on each of the questions.

Design Overview

In the broadest sense, our design will start small and simple and grow in complexity, requirements, and power over a three-to- five year period. We believe that we will be collecting, in large part, baseline information during 1988. We are interested

in one primary target during the first phase of work: students outcomes. Although students data will be our emphasis, we will attend also to questions related to teachers and classroom process, perhaps using already in place ACOT research components. Our own focus, and whether to augment or supplant these approaches will be reserved for later years. We will also extend our interests to family and to school level processes and effects during subsequent phases of the study.

Student Targets

Specifically, we are interested in knowing the comparative impact of ACOT on three cohorts of students: ACOT students over time as they go up the grade structure of schools; students taught subsequently by an increasingly experienced ACOT teacher team, for instance 5th grade students in 1988 compared to 5th grade students in 1989, and on ACOT compared to non-ACOT students in their same and different schools.

The designs for such studies will take the following form, illustrated in Figure 1, in order to facilitate the following comparisons of three groups.

Figure 1

Design for Student Outcomes

Minimum Measurement Schedule	ACOT Students	Non-ACOT Students in ACOT schools	Non-ACOT Students in non-ACOT schools
Time 1 Spring 1988			
Time 2 Fall 1989			
Time 3 Spring 1989			
Time N			

In implementing this design, we would clearly expect to have greater data collection intensity for ACOT participants. We need to assure that comparisons between ACOT and non ACOT students can be made longitudinally both for classrooms and individuals so that we can capture both the cumulative and delayed effects of the experience that are undetectable immediately.

Secondly, and to a lesser degree at the outset, we will be interested in effects on teachers and would hope to use a similar but less extensive design in collecting teacher data. Our approach for the first year will be to piggyback on other classroom observation measures and to administer relatively brief instruments to teachers to elicit

their perception of ACOT effects on classroom process, worklife, and students. The teacher focus is to be deferred not because of any absolute value, but because of our sense of teachers' heavy existing workload and data requirements in the project. Should teachers' become more available, even this year, we will be ready to create additional measures and procedures as desired.

Similarly, we expect to be relatively light in our efforts to develop new approaches to the assessment of instructional organization during this first year (See Levine's attached plan as a partial idea set), partly because we are aware of the parallel efforts serving these issues, undertaken by the ACOT project. However, some of our attention to teachers and classroom process will be focused in this and subsequent years on the issue of identification of new objectives and new outcomes that can be subsequently verified, validated, and incorporated as legitimate ACOT outcomes, optional ACOT objectives for participants, and certainly, as measures in the STAR plan.

Core Measures in STAR

Below is a set of measures we believe useful in addressing the evaluation questions we have listed. In conformance with our model, we will be trying to determine from all principal players, first, if there are other questions which should be addressed, and second, if the measures we have suggested are appropriate.

What Are the Effects of ACOT on Students?

Interviews with ACOT teachers, coordinators, and administrators as well as on-site observation suggest a common core of outcomes which are of interest and potentially applicable across the sites.

Student achievement in basic academic skills. We believe we need to develop alternative approaches that attempt to optimize both cross-site comparisons and within site sensitivity. Because of district mandates, each of the ACOT schools routinely administers standardized tests of reading, mathematics and language, and scores on these measures over time are easily available through cumulative folders for ACOT and non-ACOT students.

We also believe it essential to have comparable standardized outcome data across sites. Because of grade level, community and curricular differences, finding a basis for comparison is always difficult. It is the apples and oranges problem, once again, no pun intended. Nonetheless, we have considered a number of options at this point. One would involve employing a linking and equating (or anchor test) approach to attempt to convert disparate district achievement measures to the same scale. This approach requires a slightly larger sample size and is most useful for comparisons across sites operating at the same grade level.

Another choice is to make comparisons where natural matches occur. This year, for instance, the Memphis and Nashville sites use the same standardized measure in their ACOT classrooms. However, because district test policies may change at different grade levels or change altogether, relying on fortuitous matches seems to be risky in the long run.

A third option, and one we endorse, involves using a test battery that is vertically equated over the broad age ranges of potential ACOT implementation. We believe that the Iowa Test of Basic Skills, or at least some subscales thereof, is an appropriate measure. The ITBS has relatively strong vertical equating (increases are comparable from grade to grade) and uses a uniform norming procedure. Thus, we would be able to compare across sites the progress students make using percentile performance, even for very different grade levels and subjects. We have greater

technical explanations for this preference, which can be presented, if desired. We also understand this option requires greater local site participation and negotiation. In any case, we do not subscribe to the proposition that such a general test as the ITBS will be sufficiently sensitive to local site emphases. However, local sensitivity could be increased by a procedure where teachers and curriculum experts matched the ITBS scales with areas of local curricular and instructional emphasis. As an added benefit, certain ITBS subscales could also be used as the anchor test items, serve to link disparate local site measures, and allow us to incorporate our first option as well.

Fourth we may be able to capitalize in CSE's participation in other national testing activities to provide comparable, standard measures. For instance, all participating sites are located in states with state assessment programs. As part of the Test Assessment Center of the Council of Chief State School Officers, a cooperative project developing common measures for school subject has been undertaken. Access and approval for use of this measures is possible. Clearly the selection of any approach will need to involve the site participation and agreement.

Criterion-referenced student writing. All teachers commented on improvements in the quality and quantity of student writing resulting from the ACOT experience, changes which will be explored using CSE developed and validated analytic scoring schemes. The schemes provide diagnostic as well as summary information about the quality of students' writing performance and may enable schools to analyze the strengths and weaknesses of their writing instruction and of individual students. The schemes were the basis for the IEA (international) study of students writing as well as for a number of state and local assessments. Not only do well defined and reliable procedures for training scorers (teachers and/or curriculum staff) and scoring student essays exist, but use of the prompts (assignments) from from the international study will enable comparisons of ACOT student performance with national and international samples. These prompts involve typical written composition genre, narration, exposition, and description.

The writing assessment will be used not only to assess the quality student writing, but also to gather additional data on the nature of ACOT effects. That is, we will ask sets of some students within each classroom to write about the effects of their ACOT experience, about their school year, or about their plans or expectations for the future. By conducting content analyses of responses, over time and between ACOT and non-ACOT students, we will have an interesting and flexible method to examine in depth a variety of outcomes. CSE, with federal support, is presently conducting research and adapting the scoring schemes for use to assess deep content knowledge. If our efforts are successful, these content-focused measures could also be employed in selected ACOT sites. ACOT and comparable non-ACOT students will be asked to write essays at the beginning, middle, and end of the school year, using matrix sampling of prompts within each classroom, as indicated in Figure 1.

Problem-solving. While teachers and coordinators each spoke about changes students problem solving, they had difficulty in operationalizing the nature of the changes, making the choice of specific instrument premature. During Phase I of the evaluation, we will be further investigating the appropriateness of available problemsolving measures while we gather additional qualitative data about the nature of apparent changes (see appendix for description of qualitative approach). We shall be looking for both cognitive and affective components in this area (i.e., measures of how student solve problems and potential problem solving consequences of work with spread sheets, databases, etc). We will also attempt to assess their willingness approach complex problems and to troubleshoot and explore alternative solutions before asking for help. Further, one might expect the database and spread sheet work to influence analysis skills. It may well be that different ACOT sites influence different kinds of problem-solving skills and will require different types of measures for the various sites.

We anticipate identification of appropriate problem-solving measures and their preliminary tryout will consume Phase I activity in this area. Phase II would see administration and analysis of measures in ACOT and comparable non-ACOT classrooms.

Locus of control or sense of efficacy. The sense of empowerment and efficacy students gained from their experiences with computers was stressed across sites. Because the locus of control construct and attribution theory has enjoyed a fair amount of theoretical attention, a number of measures of this construct exist—however, with varying credibility and technical underpinnings. CSE used the Intellectual Achievement Responsibility Scale (IAR, a research instrument) in an early study of state-wide reform in California, and can provide some point of comparison for ACOT, albeit dated. The commercially published School Attitude Measure (SAM) includes an Instructional Mastery subscale, another source for this area. The SAM instrument has the advantage of being nationally normed, while the IAR derives from a stronger research base. After verifying that these two measures are the best of their type, we would plan to administer both instruments and then to use the results from Phase I to conduct validity analyses.

Attitudes toward school or motivation for schooling. Like the locus of control area, a number of both commercially published and public domain measures are available, including those CSE has used in other studies. We propose a parallel approach to the locus of control issue (i.e., administer the SAM and a shorter, public domain scale during Phase I and use validity studies from these data to verify these selections for Phase II data collection).

Student attendance data, gathered from archival data (i.e., cumulative folders) for ACOT and comparable non-ACOT students will provide additional evidence of attitudes toward school and motivation for schooling.

Academic self-concept. Data will be gathered using the SAM, enabling comparisons of ACOT students to a national norm group and to themselves over time (prior to, during and subsequent to ACOT).

Future educational and career plans. The plans for writing assessment summarized above mentioned plans to analyze the content of student essays on this topic. Questionnaire items also will be developed, particularly to assess changes over time.

Use of time at home. The amount of TV watching and book reading will be investigated in student and parent questionnaires. Ultimately, on-line records of computer use for homework, paid work, or leisure by ACOT students would be desirable.

Site-specific curricular and instructional goals. Phase I of the evaluation will be used to identify important, site-specific goals. These will be a target of assessment during Phase II.

How Does the ACOT Approach Influence the Organization and Delivery of Instruction?

The following will be investigated through a combination of classroom observation and student and teacher questionnaires (Additional detail on qualitative observation approaches can be found in appendix). The distribution of effort by CSE against these issues will be limited in year one, with the exception of teaching and instructional goals.

1. Teaching and instructional goals

2. Degree of individualization/group work

3. Curricular balance (The concern that computer literacy and keyboarding skill development may be pushing out science and social studies; availability of software in these latter subjects also push in this direction)

4. Pacing

5. Nature of student/teacher dialogue

6. Nature and frequency of teacher-student interactions

7. Nature of student-student interactions/amount of peer tutoring.

8. Time on task

9. Amount and completion of homework

10. Nature of instructional planning

We understand collateral ACOT efforts are directed to many of these issues. It is our interest to explore to the extent to which some of these measures can be collected and aggregated in automated form.

How Does ACOT Affect Teachers?

The following teacher issues could be examined via classroom observation, teacher and administrator questionnaires and detailed interviews. CSE project attention on this general area, however, cannot reasonably begin until we get a sense that teachers can handle the data requirement.

1. Role (e.g., manager vs. lecturer)

2. Sense of professionalism

3. Efficacy

4. Enthusiasm/burnout

5. Expectations for students

6. Leadership/professional development

7. Comfort, ownership of technology

8. Use of time/total time

What are ACOT Effects on the Family of ACOT Students?

A brief parent survey and documentation of attendance at school events, of help, and of volunteering will be prepared. Specific issues will include:

1. Parental attitudes toward school

2. Parental involvement/willingness to be involved in school activities

3. Parental expectations for their children

4. Parental perceptions of ACOT effects, changes in their children

5. Changes in parental expectations for themselves or other family members

What Other Unintended Effects, Positive or Negative, May Be Attributed to ACOT?

Hypotheses are developed both by the analysis of explicit questions posed to participants and in the explanations posited for relationships among data found in the study. Below is a model, Figure 3, that simply illustrates the utility of this information. However, the search for unanticipated effects is as much a frame of mind as a set of procedures.

Procedures and Timelines

The evaluation plan, as alluded to above, anticipates a multiphase effort. Phase I will concentrate on improving the model, testing the feasibility of the design, and refining data collection approaches. Included in this first phase (Spring, 1988) will be collection of baseline data in prespecified and agreed areas (student academic achievement, writing, locus of control, attitudes toward self and school). We will also undertake additional exploratory work to permit specification and selection of appropriate instrumentation (problemsolving, classroom process), and additional information gathering to identify site specific curriculum and instructional goals which should be assessed. This work is planned to be conducted in the three selected ACOT sites, Memphis, Nashville, and Columbus.

Phase II and beyond will expand the scope to all ACOT sites, with an iterative process of collaborative planning, data collection, analysis, reporting, and identification of refined goals. It will also extend the intensity and breadth of measure, or reduce them, as appropriate. We will begin the collection and analyses of data on all core outcome measure and cross-sectional comparisons of ACOT and comparable non-ACOT students. Simultaneously, we will be engaged in database design and implementation.